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Course Code:	**24BSPH101**
Course Name:	**ENGINEERING PHYSICS**

MODULE I-PROPERTIES OF MATTER

S.No	Part A –Questions/ 1 Mark	K – Level	CO	CAT
1	Stress can be defined as a)Force per unit length **b)Force per unit area** c)Force per unit volume d) Force per mass	K1	1	I
2	The change per unit dimension of the body is called a)**Strain** b)Stress c)Elasticity d)Plasticity	K1	1	I
3	What is the relationship between stress and strain in Hooke's law? a)inversely proportional **b)directly proportional** c)Exponential d)Constant	K1	1	I
4	Stress-strain curve can be used to read a)the structural load of materials b)the bearing capability of materials c)the loadability of materials **d)All of the mentioned**	K2	1	I
5	The slope of the stress-strain curve in the elastic deformation region is _____ a)**Elastic modulus** b)Plastic modulus c)Poisson's ratio d)None of the mentioned	K1	1	I
6	The stress strain curve is linear upto **a)Proportional limit** b)Yield point c)Breaking point d)Ultimate tensile stregth	K1	1	I
7	Which point on the stress strain curve occurs after the proportionality limit? a)Upper yield point b)Lower yield point **c)Elastic limit** d)Ultimate point	K1	1	I
8	The stress at which extension of a material takes place more quickly as compared to the increase in load is called a)elastic point b)plastic point c)breaking point **d)yielding point**	K2	1	I
9	Which point on the stress strain curve occurs after the ultimate point? a)Last point **b)Breaking point** c)Elastic limit d)Material limit	K1	1	I

10	The ratio of lateral strain to the linear strain within elastic limit is known as a)Young's modulus b)Bulk modulus c)Rigidity modulus **d)Poisson's ratio**	K1	1	I
11	Poisson Ratio relates to which one of the following. a)Strength b)Molecular space **c)Elasticity** d)Atomic Structure	K1	1	I
12	A pair of two equal and opposite force acting on a body, in such a way that do not lie in the straight line is a)Torque **b)Couple** c)Moment of a Force d)All the above			
13	A rotating member, usually of circular cross section, used to transmit power or motion from the source to load is a)Connector **b)Shaft** c)Girder d)All o f the above	K1	1	I
14	The twisting couple of a wire is given by $a)\ \frac{\pi n\theta r^2}{2l}$ $b)\ \frac{\pi n\theta r^4}{2l}$ $c)\ \frac{\pi n\theta r^3}{2l}$ $d)\ \frac{\pi n r^4}{l}$	K1	1	I
15	The couple per unit twist of the hollow cylinder of inner radius r_1 and outer radius r_2 is given by $a)\ \frac{\pi n\theta\left(r_1^2-r_2^2\right)}{2l}$ $b)\ \frac{\pi n\theta\left(r_2^2-r_1^2\right)}{2l}$ $c)\ \frac{\pi n\left(r_1^4-r_2^4\right)}{2l}$ $d)\ \frac{\pi n\left(r_2^4-r_1^4\right)}{2l}$	K1	1	I
16	What is the product of force and radius? a)Twisting shear b)Turning shear **c)Turning moment** d)Tilting moment	K2	1	I
17	When a beam is subjected to simple bending, _____ is the same in both tension and compression for the material. **a) Modulus of elasticity** b)Modulus of section c) Poisson ratio d) None	K1	1	I
18	In bending of a beam, which layer is neither elongated nor shortened? a)Axis of load **b)Neutral axis** c)Center of gravity d)None of mentioned	K1	1	I
19	At the neutral axis, bending stress is ____ a)Minimum b)Maximum **c)Zero** d)Constant	K2	1	I
20	For a rectangular bar geometrical moment of inertia is $a)\ \frac{bd^3}{12}$ $b)\ \frac{bd}{12}$ $c)\ \frac{bd^2}{12}$ $d)\ \frac{bd^4}{12}$	K1	1	I
21	For circular cross section moment of inertia is $a)\ \frac{\pi}{4}$ $b)\ \frac{2\pi}{4}r^4$ $c)\ \frac{3\pi}{4}r^4$ $d)\ \frac{\pi}{4}r^4$	K1	1	I
22	A cantilever is a beam whose a)Both ends are fixed b)Both ends are supported on hinges	K1	1	I

	c)One end is fixed and other end is free d)None of the mentioned			
23	The maximum bending moment in a cantilever beam occurs at the ------- a)Free end b)Midpoint **c)Fixed support** d)Load point	K1	1	I
24	The maximum depression of a cantilever of length l applied with load W at the free end is $a)\frac{Wl^3}{3YI}$ $b)\frac{Wl^3}{8YI}$ $c)\frac{Wl^3}{16YI}$ $d)\frac{Wl^3}{48YI}$	K2	1	I
25	In which type of bending every element of the beam is bent with the same radius of curvature? **a)Uniform bending** b)Non-uniform bending c)Both uniform and Non-uniform d)None of he mentioned	K1	1	I
26	In which type of bending every element of the beam is bent with the different radius of curvature? a)Uniform bending **b)Non-uniform bending** c)Both uniform and Non-uniform d)None of he mentioned	K2	1	I
27	Where I-shaped girders can be used? a)Construction of bridges b)Construction of buildings c)Construction of dams **d)All of the mentioned**	K1	1	I

S.No	Part B–Questions/2 Marks	K – Level	CO	CAT
1.	Define elasticity.	K1	4	I
2.	State Hooke's law.	K2	4	I
3.	Define Young's modulus of elasticity.	K2	4	I
4.	Define bulk modulus of elasticity.	K1	4	I
5.	Define rigidity modulus of elasticity.	K1	4	I
6.	Define Poisson's ratio.	K2	4	I
7.	Give the relation between the three moduli.	K1	4	I
8.	What is stress?	K2	4	I
10.	What is cantilever?	K1	4	I
11.	What are I-shape girders?	K2	4	I
12.	What are the applications of I-shape girders?	K2	4	I
15.	What is bending moment of beam?	K2	4	I
16.	Differentiate uniform & non – uniform bending.	K1	4	I

17.	Define neutral axis.	K2	4	I
18.	Define yield point.	K2	4	I
19.	Define Ultimate Tensile Strength (UTS).	K2	4	I
20.	What are the uses of stress strain curve?	K2	4	I

Unit - I / Part - B / 10 Marks					
S.No	**Questions**	**Marks Splitup**	**K – Level**	**CO**	**CAT**
1.	Describe with necessary theory, the method to determine the Young's modulus of the material of a rectangular bar by uniform bending.	10	K2	1	I
2.	Derive an expression for depression at the free end of a cantilever due to load. Describe an experiment to determine the Young's modulus of the cantilever material using this expression.	10	K2	1	I
3.	i) Explain stress – strain diagram. ii) Write short notes on I shape girders.	6 4	K2 K2	1	I
4.	Describe how the rigidity modulus of the material in the form of a wire may be determined by symmetrical mass and a torsional pendulum.	10	K2	1	I
5.	Derive an expression for the elevation at the centre of a beam which is loaded at both ends. Describe an experimental to determine young's modulus of a beam by uniform bending.	10	K2	1	I
6.	Deduce an expression for the couple to produce a unit twist in a long cylindrical wire fixed at one end.	10	K2	1	I
7.	i) Deduce an expression for the internal bending moment of a beam. ii)Write short notes on I shape girders	6 4	K2 K2	1 1	I I
8.	Derive an expression for the depression at the midpoint of a beam loaded at middle of the beam. Write short notes on I shape girders.	7 3	K2 K2	1 1	I I
9	Deduce an expression for the couple to produce a unit twist in a long cylindrical wire fixed at one end. How is it used in the determination of modulus of rigidity of a wire.	10	K2	1	I

MODULE II – MECHANICAL WAVES AND LASER

S.No	Part A - Questions	K –Level	CO	CAT
1.	What type of wave is characterized by oscillations occurring perpendicular to the direction of wave travel? **a)Transverse waves** b)Longitudinal waves c)Sound waves d)Mechanical waves	K1	2	1
2.	In which type of wave do particles oscillate parallel to the direction of wave travel? a)Surface waves b)Transverse waves **c)Longitudinal waves** d)Electromagnetic waves	K1	2	1
3	If two waves travelling the same distance result in destructive interference, what can be concluded about the relationship of their paths? a)They travel equal distance b) They are differ by a whole number of wavelength **c)They differ by a odd number of half wavelength** d) They are completely in phase	K1	2	1
4	What is the relationship between the distance between two consecutive nodes and the wavelength? **a)It is half of the wavelength.** b) It is equal to the wavelength. c)It is twice the wavelength. d)It has no relation to the wavelength.	K1	2	1
5	The velocity of the transverse waves on a stretched string is given by **a)** $v = \sqrt{\frac{T}{m}}$ b) $v = \sqrt{\frac{2T}{m}}$ c) $v = \sqrt{\frac{m}{T}}$ d) $v = \sqrt{\frac{m}{2T}}$	K1	2	1
6	The velocity of the transverse waves on a stretched string is given by $v = \sqrt{\frac{T}{X}}$ the unknown term X is a)Bulk modulus of the medium b)Young's modulus of the medium **c)Linear mass density** d)Density of the gas	K1	2	1
7	A string of length 3m has 15g mass. The speed of simple harmonic waves produced in it is 40m/s. The tension in the string is a)6N **b)8N** c)12 N d)16N	K1	2	1
8	If tension of sonometer wire is made of 4 times, then its frequency will change by a factor of **a)2** b)4 c)6 d)0.5	K1	2	1
9	The phenomenon because of which colour as well as dark pattern appears on a thin soap film in bright sunlight is known as? a)Diffraction of light b)dispersion of light c)polarization of light **d)Interference of light**	K1	2	1
10	Two waves are propagating with same amplitude the nearly same frequency in opposite direction they result in ---------- a)beats **b)stationary wave** c)resonance d)wave packet	K2	2	1
11	Standing waves cannot be produced **a)When two identical waves with a phase difference 180 degree moving in the same direction.** b)On a string clamped at both the ends. c)When incident wave reflected from a wall. d)None of the above.	K2	2	1
12	The standing wave formed in a pipe open at both the ends, the first harmonic has a)2 nodes and 1 antinode b)1 node and 1 antinode **c)1 node and 2 antinodes** d)2 nodes and 2 antinodes	K1	2	1
13	For a stationary wave if frequency is equal to ----------then it is called fundamental mode.(v is the speed of travelling wave and length l)	K1	2	1

	$a) = \frac{v}{l}$ $b) = \frac{2v}{l}$ $c) = \frac{v}{4l}$ $d) = \frac{v}{2l}$			
14	Which of the below mentioned properties makes difference between progressive and stationary waves a)Frequency b)Amplitude **c)propagation of energy** d)Phase of wave	K2	2	1
15	An antinode on a wave is the point at which ---------- a)amplitude is zero b)amplitude is mean value **c)amplitude is maximum** d)amplitude is squared	K2	2	1
16	When two waves of same frequency and amplitude move with the same speed in the opposite direction produces --------- **a)stationary waves** b)beat c)progressive waves d)None of the above	K1	2	1
17	The amplitude of a progressive wave is A and angular frequency is ω then energy density of the wave is (ρ is density of the medium) $a) \frac{1}{2}\rho\omega^2 A^2$ $b) \frac{1}{4}\rho\omega^2 A^2$ $c) \frac{1}{4}\rho^2\omega^2 A$ $d) \frac{1}{2}\rho^2\omega^2 A$	K1	2	I
18	What occurs during constructive interference of waves? a) Waves cancel each other out. b) Waves meet out of phase. **c) Waves meet in phase, amplifying the wave**. d)Waves travel in the same direction.	K1	2	I
19	What is the result of destructive interference? a) Waves combine to form a larger wave **b) Waves cancel each other out.** c) Waves travel faster. d)Waves change direction.	K1	2	I
20	Snell's law states that n= $a) \frac{\sin i}{\sin r}$ $b) \frac{\sin i}{\sin 2r}$ $c) \frac{\sin 2i}{\sin r}$ $d) \frac{\sin r}{\sin i}$	K2	2	I
21	When a light ray travels from rarer to denser medium, then $a) \angle i > \angle r$ $b) \angle i < \angle r$ $c) \angle i \leq \angle r$ d)None of the above	K2	2	I
22	When a light ray travels from denser to rarer medium, then $a) \angle i > \angle r$ $b) \angle i < \angle r$ $c) \angle i \leq \angle r$ d)None of the above	K2	2	I
23	In air wedge experiment the thickness of a thin specimen can be determined using the formula $a) d = \frac{2\beta}{l\lambda}$ $b) d = \frac{l\beta}{2\lambda}$ $c) d = \frac{\lambda\beta}{2l}$ $d) d = \frac{l\lambda}{2\beta}$	K1	2	I
24	The characteristics of laser beam are a)Highly directional b)Highly intense c)Highly monochromatic **d) All of them**	K1	2	I
25	In a laser what type of emission occurs when an excited atom emits a photon without any external stimulus? a)stimulated emission b)induced emission **c)spontaneous emission** d)coherent emission	K1	2	I
26	Which process is responsible for amplification of the light in LASER? a) blackbody radiation b) Einstein oscillation c)Planck's radiation **d) stimulated emission**	K1	2	I
27	Pumping is done in order to achieve _____ a) Steady state **b) Population inversion** c) Equilibrium d) Photon emission	K1	2	1
28	What is the need to achieve population inversion? **a)To excite most of the atoms** b)To bring most of the atoms to ground state	K1	2	1

	c)To achieve stable condition d)To reduce the time of production of laser			
29	What is the primary function of laser cavity or resonator in a laser system? a) To provide a medium for absorption b) To convert electricity to light **c) To provide feedback and amplify laser light** d)To generate heat	K1	2	1
30	Which of the following is an example of optical pumping? **a) Ruby laser** b) Helium-Neon laser c) Semiconductor laser d) Dye laser	K1	2	1
31	What is the role of nitrogen in Carbon dioxide laser? a) **to populate Carbon dioxide molecule** b) act as an coolant c) to depopulate Carbon dioxide molecule d) All the above	K2	2	1
32	What is the role of Helium atoms in Carbon dioxide laser? a) to populate carbon dioxide molecule b)act as an coolant **c) to depopulate carbon dioxide molecule** c) All the above	K2	2	1
33	The output power of the Carbon dioxide laser can be increased by **a) increasing the length of the tube** b) increasing the pressure inside the tube c) by increasing both the length of the tube or pressure inside the tube d) Cannot be increased	K1	2	1
34	The applications of Carbon dioxide lasers are **a) Industry** b) Remote sensing c) Medical d) All the above	K1	2	1
35	Which device is used to control the temperature inside the elliptical cavity of a Nd-YAG laser? a)pressure pump **b)Water or air cooling arrangements** c)Heat sink d) Flash lamp	K1	2	1
36	What is a primary function of a flash lamp in Nd-YAG laser? a)To cool the laser cavity **b) To facilitate optical pumping** c) To emit laser radiation d) To absorb excess heat	K1	2	1
37	The wavelength of light produced during the laser transition from metastable state to ground state in Nd-YAG is typically in which region? a)Visible b) Ultraviolet **c) Infrared** d)X-Ray	K2	2	1

S.No	Part A - Questions	K –Level	CO	CAT
1.	What is Transverse wave motion?	K1	2	1
2.	What is longitudinal wave motion?	K1	2	1
3.	What are standing or stationary waves?	K1	2	1
4.	What are Plane Progressive or Travelling waves?	K1	2	1
5.	What are nodes and antinodes?	K1	2	1
6.	What are the characteristics of stationary waves?	K1	2	1
7.	What are the characteristics of plane progressive waves?	K1	2	1
8.	State the differences between progressive and stationary waves?	K2	2	1
14.	Mention the Characteristics of a laser beam.	K1	2	1
15.	Differentiate ordinary light with Laser.	K2	2	1

16.	What is stimulated absorption?	K1	2	1
17	What is stimulated emission?	K1	2	1
18	What is spontaneous emission?	K1	2	1
19	Compare stimulated and spontaneous emission.	K2	2	1
20	What are the roles of He and N_2 in CO_2 Laser?	K2	2	1
21	What are the basic components of Laser?	K1	2	1
22	Mention the classifications of Laser based on active medium.	K1	2	1
23	What is population inversion?	K1	2	1
24	What is meant by pumping action?	K1	2	1
25	What is the role of the optical resonator cavity in the laser?	K1	2	1

Unit - IV / Part - C / 10 Marks					
S.No	**Questions**	**Marks Splitup**	**K – Level**	**CO**	**CAT**
1.	Derive the differential equation of wave motion.	10	K2	2	1
2.	Deduce the wave equation for plane progressive wave.	10	K2	2	1
3.	Derive the wave equation for standing waves.	10	K2	2	1
4.	Deduce an expression for energy transferred though vibration of the string.	10	K2	2	1
5	Explain the formation of fringes in an air wedge shaped film .How is the thickness of wire determined by this method?	10	K2	2	1
6	Describe the vibration modes of CO_2molecules. Explain the principle, construction and working of a CO_2 laser.	10	K2	2	1
7	Explain the principle, construction and working of Nd-YAG laser.	10	K2	2	1
8	For atomic transitions, derive Einstein's relation and hence deduce the expressions for Einstein's coefficient.	10	K2	2	1

Course outcomes:

CO1: To understand the mechanical properties of materials. (K2)
CO2: To express the knowledge of waves and to discuss about lasers and its applications (K2)
CO3: To understand the properties of electromagnetic waves and its propagation in different medium (K2)
CO4: To discuss the dual nature of matter and radiation and application of one dimensional Schrodinger's wave equations to a matter wave system (K3)
CO5: To understand the basics of crystal, its structure determination and different growth techniques. (K2)
CO6: To discuss the heat transfer in different media and its applications. (K3)